The Usage of 360 Video for High Altitude Ballooning and Education

Mary Clare Greenlees, Adler Planetarium

ADLER PLANETARIUM

Illinois Space Grant Consortium

Abstract

Throughout the spring and summer of 2017, high school students at the Adler Planetarium designed and tested methods of capturing 360 degree virtual reality video from a high Altitude Balloon platform. Beginning with the off-the-shelf 360 degree cameras, we used an iterative process of designing and testing to solve issues such as power management, calibration and post processing. The project involved learning new skills and technologies such as 3D printing, engineering, scripting, and video editing. For this project we were able to delve deeper into not only science and engineering, but also the art behind visualizing near space flight. We hope that by harnessing these experiences and methods, we will be able to engage teens by intertwining arts and sciences. On August 21, 2017 the system we designed captured a view of total solar eclipse from the stratosphere. I will present those results.

Opportunity

Far Horizons is the Adler Planetarium's people powered space program. Scientists and engineers work in conjunction with interns, students, and volunteers in a peer mentor structure.

High School students had the opportunity to be part of a paid spring internship in the Far Horizons Lab. The focus of this internship was to write a SOP for 360 Cameras as well as create a trailer to preface the Eclipse by compiling flight footage and music.

Mission Goals

The 360 Video Mission Goals:

1.Introduce engineering and art related challenges to high school students.

2.Capture Eclipse Totality from the stratosphere that can be viewed by experts and novices alike.

3.Address engineering challenges to complete the goals.

a. Address problems associated with the camera lenses becoming iced over during flight

b. Solve the problem of how to mount the cameras so the payload doesn't obscure the view

c. Provide power in order to keep the cameras running longer.

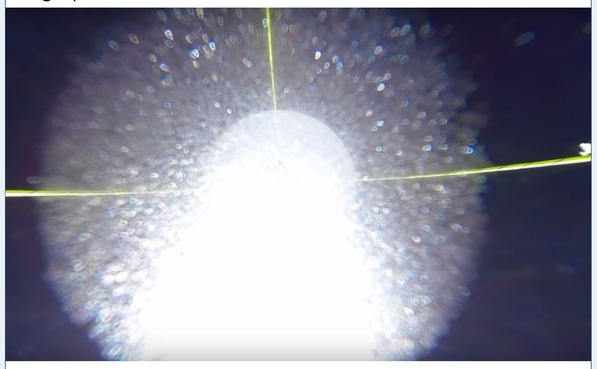
4. Create an outreach tool to the public for the Adler Planetarium

Process

Throughout this process, we quickly learned the importance of documentation. It allowed us to pinpoint which areas we need to fix and by documenting our process, we hope to help others trying to reach similar goals.

Flight 102

April 8, 2017 was the first flight we had to test the 360 camera system. After analysis of the footage, we isolated a few issues to focus on. One observation we had was that the camera footage was blurry. Also there was a lot of ice build up on the inside of the camera housing. Although these were more cosmetic issues to be solved, the greater issue was the battery life. We calculated at around 60,000 feet (of an 85,000 foot flight) both cameras failed.



Flight 103

May 7, 2017. An issue we were able to quickly remedy from the past flight was the blurry footage as well as decreasing the amount of frost. We drafted a SOP (Standard Operating Procedure) to properly clean the lenses and operate the system. And we drilled holes into the sides of the camera housing in order to let moisture escape. After analyzing the footage, we discovered that the top camera was tilted, meaning that while putting the camera in place, it got bumped so that the picture was not straight. A solution we had to this was to custom 3D print a mount to fix this.

Flight 104

June 3, 2017. This flight primarily focused on testing the custom mount, which held up to a full flight and retrieval.

Flight 108

June 28, 2017. Unfortunately on this mission, there was little documentation available since the files were accidentally deleted when attempting to stitch the clips together.

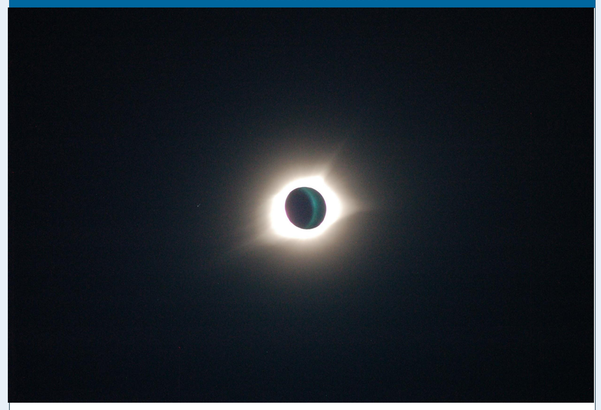
Flight 109 and 111

July 26, 2017 and August 10, 2017. For subsequent flights we tested all the systems. But, in the meantime we worked on creative aspect such as editing video, scripting a trailer, and composing music.

Flight 112

August 21,2017: Eclipse Mission. In order to capture totality, Adler staff launched from Perryville Municipal Airport in Perryville, MO. Temperatures were as high as 96 degrees Fahrenheit, but that did not dampen the mood. We launched at approximately 11:45 am, so as to reach an altitude of 80,000 to 90,000 feet during totality at 1:18 pm. Although there were minor icing issues, the result was breathtaking and spectacular.

Recommendations



Though our mission was an overall success, there are still a few issues that need to be addressed. One of which is icing of the lens. Although we were able to decrease it, there was still ice that ended up on the lens during the Eclipse Mission. We had been playing around with the idea of having an internal heating source, however due to time constraints we weren't able to fully fledge out that plan.

Reflections

Through trial and error, we were able to complete our original mission goal and capture beautiful 360 footage of the August 21 Eclipse. Not only were we able to learn about engineering challenges, such as adjusting the Camera Housings, or 3D printing a mount. They also had to work with video editing software, and in the process created a 90 second trailer prefacing the Eclipse mission. In doing so, some interns got to write their own music to match the trailer. This unique intersection between art and science created for an amazing learning opportunity for myself and other students.

Acknowledgements

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